The Veterinary Record.

FOUNDED BY WILLIAM HUNTING, F.R.C.V.S., 1888.

No. 27. JULY 5, 1930. VOL. 10.

Some Extracts from Recent Literature on Tetanus.*

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When I received an invitation from the Secretary to read a paper before this Society, I found myself in a position of some difficulty. I felt that it was my duty to accept, but at the same time I doubted whether, in view of the nature of my practice, I could produce a paper which would stimulate discussion. Before accepting, therefore, I explained my difficulty to the Secretary, and pointed out that there would be a risk of my appearing to lecture to the Society. I was anxious to avoid creating any impression of that kind. He overcame my scruples and I then accepted the invitation, suggesting that I should collect materials from the recent literature on tetanus.

I do not propose, as I am afraid the somewhat inept wording of the title would appear to suggest, reading you a series of abstracts from foreign journals with the specific reference of each. I have attempted to construct a short consecutive account of the work that has been done in France during the past four or five years, and the sources of my information will be given at the end of the paper. I may perhaps begin by reminding you of the most salient points connected with tetanus, ignoring for the moment the recent work.

Tetanus is caused by a bacillus which gains access to the animal body, as a rule, by way of wounds. The symptoms which characterise the disease are caused, not by the general invasion of the body by the bacillus, but by a toxin elaborated by the bacillus. This toxin has a special affinity for the nervous system. The clinical picture of tetanus can be produced experimentally by the injection of a fluid culture of the bacillus which has been rendered germ free, and it is a rather remarkable fact that there is an interval of considerable length between the injection of the tonic liquid and the appearance of symptoms. This interval cannot be reduced by increasing the dose of toxin.

The well-known anti-tetanic serum is obtained from animals that have been immunised and then hyperimmunised against the toxin. Like other anti-sera, the immunity conferred by anti-tetanic serum is of brief duration, lasting for not more than 12-14 days. It appears to be a fact that this serum, by whatever path it is administered, is of little or no value when once symptoms have made their appearance.

The treatment of tetanus is, I believe—and I shall no doubt be corrected if I am wrong—to protect the affected animal against external stimuli as completely as possible.

It is probably true to say that nearly every discovery in any of the branches of science has its origin in some earlier discovery; few discoveries are made by chance. This is true with regard to what has been done recently in the investigation of tetanus.

It has been known for many years that tetanus toxin is not an absolutely stable substance. It has been known that under certain conditions tetanus toxin may lose its toxicity, and that the detoxic toxin is capable of stimulating an immunity response on injection into the animal body.

Attempts have been made at different times to devise means whereby toxins could be rendered harmless without destroying their antigenic properties, but until recently with indifferent success.

The work to which I wish to refer has been carried out by Ramon and Descombey in France, and it originated in the researches of Ramon in connection with diphtheria—a disease also caused by a toxin-producing organism. It was at Ramon's suggestion that Descombey carried out, largely in collaboration with Ramon, parallel investigations in connection with tetanus.

Ramon, in the first place, investigated the means whereby diphtheria toxin could be rendered non-toxic without destroying its antigenic properties and he found that formalin, acting at body temperature, could produce this change. Formic aldehyde is not the only substance which has been found to possess this power, but so far it has yielded the best results. Iodine has been used to achieve this purpose, and indeed was so used to prepare detoxicated tetanus toxin during the war, but the results are said to be greatly inferior to those produced by formalin.

Ramon has given the name " anatoxin " to these harmless derivatives of bacterial toxins which still retain their power of producing an immunity response when injected into animals.

Ramon's original aim in investigating the production of " anatoxin " was to reduce the losses and risks attaching to the preparation of diphtheria serum.

The process of immunising and hyperimmunising horses against diphtheria or tetanus toxins is a long process and losses of serum producers are not infrequent.

In one of the papers published, Ramon and Descombey point out that the elaboration of a safe method of immunising animals against tetanus has an interest which is not limited to those concerned in the production of anti-tetanic serum. It would prove an enormous boon in time of war if horses could be actively immunised against tetanus. At such time it is scarcely practicable to use anti-tetanic serum effectively. Further, they point out that there are certain areas which are " tetanus areas "; that is to say, areas in which any wound is likely to be followed by tetanus.

Ramon saw the necessity as having some means of checking the antigenic properties of the anatoxins prepared, and to this end he applied the " flocculation " test. I will not go into the details of this test but, broadly

*Paper presented to the Central Division N.V.M.A., at 10 Red Lion Square, London, on June 5th, 1930.

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speaking, it is carried out by mixing anatoxin and antiserum of standardised potency in varying proportions, the amount of flocculation resulting indicating the antigenic value of the anatoxin. Similar flocculation is produced when toxin and anti-toxic sera are mixed, and Ramon found that it was possible to prepare anatoxins which could give just as marked flocculations as the unaltered toxin. The time required for flocculation, as well as the extent of the reaction, is taken into consideration.

Tetanus anatoxin is prepared as follows:—An active tetanus toxin will kill a guinea-pig weighing 300 grammes in four or five days when a dose of ·0001 c.c. is injected. To such a toxin formalin (40 per cent. solution of formaldehyde) is added in the proportion of 2 c.c. per litre. The flask is then placed in an incubator at body temperature. If samples are taken from the flask at intervals and injected into guinea-pigs, it is found that the toxicity of the liquid gradually decreases. The fall in toxicity is especially marked during the first few days. After 48 hours' incubation a dose of ·0005 c.c. produces only a localised tetanus, while the fatal dose is ·01 c.c., *i.e.*, 100 times as large as it was prior to the addition of the formalin. After five or six days, a dose of 5 c.c. produces no local tetanus, but the toxicity is not completely destroyed because generalised fatal tetanus occurs about the fifth day. With prolonged incubation the period elapsing between injection and the development of generalised tetanus increases, but after about three weeks' incubation it is found that an injection of even 10 c.c. is without any harmful effect whatsoever. The toxin is by this time entirely converted into anatoxin. Flocculation tests of the toxin prior to treatment and the anatoxin give absolutely parallel results as regards the amounts required to produce the reaction with the standardised anti-tetanic serum, but the time required for the completion of the reaction is longer in the case of the anatoxin than of the toxin. The "time of flocculation," as Descombey calls it, varies directly with the period of incubation for the mixture of formalin and toxin.

If one were to increase the amount of formalin to five per thousand the toxicity would decrease far more rapidly, but "the time of flocculation" is greatly prolonged. Ramon has shown, in his work on diphtheria, that anatoxins which flocculate very slowly are of inferior antigenic value. If smaller quantities of formalin—say 1 or even 0·5 per thousand—are used, the incubation has to be prolonged because anatoxin is formed far more slowly. Descombey says that this is not to be advised. In preparing tetanus anatoxin one must, therefore, use an amount which will destroy the toxicity as quickly as possible without altering the antigenic power of the anatoxin.

The earlier experiments in which the antigenic properties of anatoxin were tested were carried out with guinea-pigs. One cubic centimetre injected subcutaneously enabled guinea-pigs to resist the intramuscular injection of a dose of toxin equivalent to several lethal doses two or three weeks later. Doses of 0·1 c.c. enabled guinea-pigs to resist the injection of ten lethal doses 16 days after vaccination. A test dose of 20 lethal doses produced local tetanus, but none of the animals died.

I have already referred to the attempts that were made to use iodine as a means of reducing the toxicity of tetanus toxin, and Descombey states that of Okuda's iodised toxin three injections each of 1·5 c.c. were required to protect a guinea-pig against one lethal dose of toxin.

Descombey emphasises the fact that it is essential to test the flocculating power and determine the "flocculating time" of all samples of anatoxin, as variation is likely to occur. He quotes a case in which two lots of anatoxin which were of the same origin flocculated at the same time, but one required four hours and the other seven for the completion of the reaction. The anatoxin flocculating with the greater rapidity was of higher antigenic power than the other. Once anatoxin has been prepared it retains its power unaltered for months in the ice-chest or even at room temperature, and Descombey describes it as a perfectly stable antigen of fixed value.

Having established the possibility of protecting guinea-pigs, Descombey turned his attention to horses, and the following are summaries of some of his experiments. Two horses were given three injections of 20, 20 and 30 c.c. of anatoxin at intervals of a week, and one week after the last each was given 2 c.c. of tetanus toxin. The test toxin was that used for the preparation of anti-tetanic serum at the Pasteur Institute, Paris, and 1 c.c. represented "several dozen" fatal doses for the horse. None showed any reaction of any kind.

Five horses were given two injections of 20 c.c. of anatoxin at a week's interval and were tested with 1 c.c. of toxin 7 to 14 days after. Again none showed any reaction. Three horses were given 15 and 20 c.c. at a week's interval and tested a fortnight later with 1 c.c. of toxin. None showed any reaction.

All these animals were handed over for hyperimmunisation and no accident of any kind occurred.

It was thus found possible to immunise horses solidly against tetanus in about two to three weeks.

It is, of course, impossible to estimate the amount of toxin that is elaborated by the bacilli in a case of natural infection with tetanus, but it appears to be extremely unlikely that in any individual case the animal is suddenly exposed to an amount of toxin equivalent to scores of lethal doses.

Descombey therefore carried out a series of experiments in which natural conditions were more closely imitated.

Sterilised splinters of wood were placed in tetanus cultures about three weeks old, and containing many spores. The following day the cultures were heated on a water bath at 80° C. for half-an-hour to kill off the bacilli, leaving the spores unaffected. The splinters were then placed in mixed cultures of staphylococci, *B. pyocyaneus* and other organisms. Splinters prepared in this way invariably caused fatal tetanus when implanted in guinea-pigs.

A batch of horses were given either one dose of 10 or 20 c.c. of anatoxin or two similar doses at an interval of a fortnight. Test splinters were inserted deeply into the muscles of the neck at intervals ranging from 10 days to 4½ months later. Untreated controls received splinters. These died, as did two of the horses which had received only one dose of anatoxin. Those which had two doses of anatoxin and one which had been given only one dose (10 c.c.) all survived.

It seemed to be clear that two injections of anatoxin produced a stronger immunity than a single dose, but there was a certain amount of variation in individual susceptibility. Having thus established the possibility of producing immunity in horses by the simple injection of two compara-

tively small doses of anatoxin, it was necessary to obtain more definite determinations of the amounts of anatoxin actually required and of the most suitable interval between the doses. With a view of obviating the sacrifice of horses used in the experiment by subjecting them to test injections of toxin, Descombey hit upon the plan of testing their sera in conjunction with tetanus toxin on guinea-pigs.

One series of horses received only one injection of anatoxin in doses ranging from 5 to 15 c.c., while a second series received two doses of 5 c.c. only at an interval of 20 days. The dose of serum was fixed at 3 c.c., and this was mixed with variable amounts of toxin, the fatal dose of which for the guinea-pig had been determined. It was found that little or no antitoxin could be detected in the sera of the horses which had received only one dose of anatoxin even in 15 c.c. quantities, but the sera of those which had two doses of 5 c.c. each contained antitoxin in considerable amount.

In a paper by Ramon in the *Comptes Rendus de la Société de Biologie* it is stated that it has been noted on a number of occasions that horses used for the production of diphtheria antitoxin which develop abscesses at the site of injection produce more potent antisera than those which develop no such lesions. In some cases the serum has been nearly twice as potent. The idea, therefore, suggested itself that the local reaction might have some part in this, possibly by retarding the absorption of the toxin. Ramon therefore tried the effect of adding various materials which would provoke a local œdema. Cultures of staphylococci killed by heat, atoxyl and other drugs, and oily emulsions were among the materials tried and all resulted in an increase in the amount of antitoxin; the best results were, however, produced by the addition of sterilised tapioca. This idea was tested by Descombey in an experiment on tetanus, and Ramon and Descombey published a joint paper on the results. The tapioca is sterilised dry and added in the proportion of 1 per 1,000.

In the first experiment three horses each received two doses of 10 c.c. of anatoxin with tapioca at an interval of a month. Twelve days later 1 c.c. of the serum neutralised 2,000 fatal doses for the guinea-pig, while three horses which received the same doses of anatoxin without the tapioca yielded a serum which would barely neutralise 300 fatal doses.

In a second series of experiments five horses received doses of 5, 10, 20, 35, 50 and 100 c.c. of anatoxin at intervals of four or five days, while five others had the same doses with tapioca added. The sera from the latter in 1 c.c. quantities neutralised on an average 10,000 fatal doses of toxin for guinea-pigs, while the same amount of serum from the former neutralised only about 200 fatal doses.

The fact that the sera of the two lots of horses which received the anatoxin without tapioca were of practically equal potency, in spite of the fact that one batch received only two injections and the other six, was rather a stumbling block until it was discovered that two doses of antigen given at a long interval are more effective than a large number given at intervals of a few days.

Further tests were carried out on 28 horses which had already received a considerable number of injections of antigen (anatoxin followed by toxin in the preparation of anti-tetanic serum). These were divided into two batches. One lot were injected with toxin in the ordinary way, while the others received toxin with tapioca. After three such injections the sera were titrated, and the potency of the sera in the second batch was twice that of the first batch.

From this the authors conclude that the period required for hyperimmunisation can be materially reduced.

Duration of Immunity.

Contrary to what has been found to be the case in the production of diphtheria anti-serum, it is not possible to produce an immediate immunity response in an animal by the injection of either tetanus toxin or anatoxin. Injections of diphtheria toxin produce a response very promptly and antibodies can be demonstrated in the serum within a period which may be measured by hours. This is not the case with tetanus. Even if 200-300 c.c. of anatoxin be injected at one time, antitoxin cannot be demonstrated in the serum before the 15th day. Experiments with guinea-pigs in the first instance and afterwards with horses (the horses used in the "splinter" experiments) showed that after the injection of anatoxin the antitoxin content of the serum continues to rise for some time.

In one of his papers Descombey states that Valliard has tested the immunity conferred upon guinea-pigs by anatoxin and he finds that it lasts for a year. Descombey has tested horses and he finds that the antitoxin content of the serum continues to rise for about six months and it then declines. But that even after 12 months, 1 c.c. of serum neutralised one lethal dose of toxin for the guinea-pig. The horses therefore still possessed what was probably a serviceable degree of immunity.

Ramon recommends that to confer the highest degree of immunity it is essential that as long an interval as possible, and in any case not less than three weeks, should elapse between the two injections of anatoxin. He suggests that this would seem to be a law of somewhat general application in connection with antitoxic and anti-microbial immunity. Ramon states that it has been found to be the case in experimental vaccination of animals with organisms of the typhoid para-typhoid group.

It would thus seem that tetanus anatoxin may serve more than one useful purpose. It can be used for the active immunisation of horses. For this purpose two small injections at an interval of three weeks suffice to confer immunity lasting for a year, and it can be used to accelerate the production of anti-tetanic serum, the risks of which are at the same time reduced to a minimum.

Treatment of Tetanus.

As I have already said, the classical treatment of tetanus aims at preventing all possible external stimuli from reaching the patient.

In the *Révue Vétérinaire*, in 1927, Veterinary-Major Agliany describes two cases of severe tetanus which recovered completely under a treatment which comprised forced exercise only, without any medical treatment of any kind. The following is a fairly full abstract of what this author says:—

Two horses, which had been out on winter manœuvres with a column to which no veterinary officer was attached, became affected with tetanus following the infliction of slight injuries, in one case to the mouth and in the other to the off-hind foot. The cases occurred with an

interval of two months. The animals were brought, with extreme difficulty, to the hospital.

Having had numerous failures in the treatment of tetanus by the ordinary methods, the author decided to try an experiment which he describes as audacious.

In the case of the first animal, trismus was complete when the animal arrived. The lips were just mobile, but no more, and the animal vainly attempted to pick up a few oats which were placed in its manger. A handful of oats was placed on the flat plate in which the manger was sunk and the horse, having pushed the oats back to the angle of the wall, picked a few, but most of them fell again. After resting a minute or two, the horse tried again to pick up the oats, and after some time occupied in this way it seemed that there was a very slight movement of the jaws. The horse did, with great difficulty, it is true, manage to eat as many oats as would fill a child's hand. These attempts to feed were made frequently during the day and very careful observation was kept, and every time there was seen a certain amount of improvement in mastication. The muscles appeared to work a little more freely. On the second day the author had the idea that exercise might perhaps have a similar effect upon the muscles of locomotion. Periods of exercise, each of twenty minutes, were given morning and evening. Movement was, of course, difficult and pauses for rest were frequent. It was, however, clearly seen that the animal moved more freely on returning to the stable than on leaving it. As the days passed and the periods of exercise were continued, improvement was more and more marked. It is true that the first few steps on leaving the stable were painful and difficult, but once movement had been started, progress became easier.

The second animal was treated in exactly the same way. But in this case there were two occasions upon which there were distinct setsback in the animal's progress and on each occasion these followed omissions of periods of exercise on account of bad weather. Subsequently the prescribed periods of exercise were carried out no matter what the weather was like. This case occurred in February.

Both these horses made uneventful recoveries, and within four weeks were normal.

No other kind of treatment was given, even the small wounds which appear to have been the original sites of infection were left untended. The author thinks that these two results are worth recording.

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Discussion.

The President (Professor James Macqueen) said that they had heard a very interesting and instructive paper from Dr. Sheather. It might not be altogether discussable at short notice, because of the frequent occurrence of technical terms and quantities, but there were certain features that he thought were open to comment, particularly the last part of the subject, and the meeting would be very glad to hear anyone's observations.

Major F. J. Taylor observed that he did not rise with a view to opening the discussion, because his laboratory knowledge of tetanus was very limited, but he was grateful to hear all the exhaustive scientific facts about that somewhat obscure disease as so ably given by Dr. Sheather. During a long period in practice he had, of course, seen a great number of cases of tetanus, particularly in the horse. He had treated some with a certain amount of success—a greater number of failures than successes, however—and it had always puzzled him why they had to obtain their tetanus antitoxin from foreign firms; it would give him much greater confidence in treating that disease if he could obtain the antitoxin, say, from Dr. Sheather, from the Royal Veterinary College, or some other place where one could have a more intimate knowledge of its preparation. It had always struck him how those foreign firms prepared nearly all their vaccines and other biological preparations, and how very backward were English bacteriologists and bio-chemists in supplying these commercial serums and vaccines now so much (in fact, too much) in use.

One of the most striking features of tetanus was its regional, or rather local, incidence. He had one particular farm in mind, where they could not think of even opening an abscess, castrating or docking an animal, or performing the most minor operation which would leave an open wound for any length of time. When such cases required attention on that farm he always removed the animal for the time being to a farm, two miles distant, to obviate the risk of soil contamination which existed in this particular area, tetanus occurring even after preventive inoculation.

Three interesting cases of tetanus had occurred in his experience, during the past two years in a local stud of heavy horses. These horses were in the habit of taking dust and refuse to a particular tip. Four horses were used at the tip and three of them had gone down with tetanus. Those occurrences established, in his mind, that that was a definite tetanus area. Two of the horses had been inoculated with antitoxin in very large doses and one of the two had gone down with the disease a second time within 12 months. At the first attack that horse was very bad, they had him in slings for six weeks. Eventually, however, he got better and went to work, but within 12 months he went down again with an attack which, however, was not so severe. Probably he had some degree of immunity conferred by the first attack and preventive inoculation treatment.

The immunity of the dog to tetanus had never been satisfactorily explained to him. On many occasions he had known carcasses of tetanus victims taken away from farms (when the farmer did not suspect the nature of the disease) and sent to fox-hound kennels, where the meat was fed to the hounds, but they did not appear to be affected by eating the tetanus-infected flesh. He would be glad if Dr. Sheather could throw a little light on that query.

With regard to the treatment of tetanus, he thought that forced exercise, even if practicable, would be "audacious" (as described in the paper): the difficulty often was to get the animal to move at all without falling down. He thought that in many cases if they were put in a dark box, kept perfectly quiet, fed on suitable food and looked after by one careful and quiet attendant, they would get well without any treatment at all.

Major Hamilton Kirk observed that it occurred to him, at the time that Major Taylor said that foxhounds could eat the carcasses of tetanus-infected animals without contracting the disease, that the reason might be that the bacillus must enter through a wound. If swallowed, the bacillus probably became destroyed by the gastric juice. At the same time, there certainly was a great degree of immunity amongst dogs, because he had never yet seen a case of tetanus in that animal. In that connection he

wondered whether the blood serum of dogs might be injected into susceptible animals as a preventive or anti-serum, because animals that were immune to a disease by nature were evidently strongly-endowed with anti-bodies in their blood.

Major Taylor remarked, concerning the suggestion that the foxhounds escaped infection because they ingested the tetanus-infected carcasses, while the bacillus required a wound to enable it to enter the blood stream, that foxhounds almost invariably had wounds or scratches on their feet or legs, and they ran in and out of the slaughter-houses with impunity, and still seemed to avoid contracting the disease.

Mr. H. E. Bywater said that he believed that it was generally held that when anti-tetanic serum was injected a fairly solid protection was conferred for nearly one month, after which the protective power declined fairly rapidly until about the third month, when it could no longer be demonstrated. He understood from Major Dalling, however, that he had recovered it at six months.

In that connection, he would like to recount an experience, which could be taken for what it was worth.

There was a brick-field on which a number of cases of tetanus occurred, and the veterinary surgeon in attendance suggested that the horses should be inoculated with anti-tetanic serum every six months. This was done, and immediately the cases of tetanus ceased, and none occurred for several years until the brick-field and the horses passed into the hands of new owners. The latter, hearing that tetanus had not been seen in the horses for a long period, ceased to have the injections made, but tetanus reappeared and again a number of horses was lost. The anti-tetanic injections were recommended and from that day onwards all the outbreaks ceased.

Professor J. McCunn said that they must thank Dr. Sheather for putting Ramon's work before them. He (the speaker) had known of it for a considerable time, but he had never had it so clearly explained to him as he had had it explained that evening. Ramon, he was sure, was on the right lines, and he was confident that good would result from his work. Further, he was certain that they would be able to immunise horses. He had had a fair amount of experience of tetanus in horses, and if they had some vaccine or anatoxin which they could give horses, for instance, corporation horses, there would be thousands of pounds saved in this country by it in a year. The only thing they had found to be a prophylactic in corporation horses was to shoe them with a leather; when that was done in one stud which had been much troubled by tetanus the disease vanished. (Practically all cases were infected *via* foot wounds which were contracted in a dust shoot.)

There was no doubt that there were areas which were particularly prone to tetanus. Essex was such an area, and practically every person who sustained a soiled wound in that county should have some antitoxin.

He had come to the conclusion that for tetanus to make headway in the system there had to be sepsis. Many cuts on dogs' feet did not go septic because the dog had the finest possible antiseptic in his own person to keep any cut or wound free from sepsis; that was, his own saliva.

He thought they could classify tetanus in horses into acute, sub-acute and mild types. There was a further type which was found occasionally and was generally associated with one of the other types, and that was local tetanus; one frequently saw it in the region of the hock. The really acute type was so rapid in its onset that he did not think they could do anything with it. With regard to the sub-acute type, in his experience a large dose of antitoxic serum, up to 40,000 units, given intravenously, seemed to yield good results. [The President (Professor Macqueen): "You mean as a curative?"] As a curative.

There was one point (proceeded Professor McCunn) he thought was essential in attempting to recover a case of tetanus. One was greatly helped if one could find the site of inoculation of the organism, and if they could find that site they should cauterise it, cut it out or otherwise destroy the tissue there, because that site was the factory for the production of tetanus toxin, and if one had a mild type of infection to deal with it meant that by this means only a small amount of toxin entered the blood stream or the central nervous system, and they could cope with it. Some time ago he recorded a number of cases with definite tetanus symptoms which recovered after the employment of these heroic measures. In his view, the mild type of case would recover irrespective of what one did or did not do for it, but in all types he thought it was essential to keep the animal quiet and still and free from all extraneous exciting sounds or irritation.

As regarded recurrence, that was very definitely established. He knew of two horses in which the disease had recurred. In one it recurred three times; at that moment he was unable to remember the intervals between the attacks, but they must have been easily a year. This horse was working to-day. The other horse had had tetanus twice; it worked for a considerable time and was disposed of about two years ago. On both occasions this animal was treated by the intravenous injection of antitoxin serum.

As regarded the dog, there was no doubt that the disease could occur in that animal. He had seen what he thought was tetanus on two or three occasions. In 1927 he removed a dew-claw from an Alsatian dog and the dog developed acute tetanus symptoms and died. As the case was recounted in the *Veterinary Record* at the time, he need not give the clinical details. He amputated the dog's leg immediately after death, and took it up to the London Hospital, where his late chief, Dr. Fildes, immediately set to work on it. Dr. Fildes recovered the tetanus bacillus from the leg and by animal experiments proved its virulence.

In connection with the different types of tetanus met with, for some two years he worked with Dr. Fildes, whose pet subject it was, and he (Dr. McCunn) used to procure soil, rubbish of all sorts and fæces for him, and he could not recollect any occasion upon which they failed to cultivate *B. tetani* from that material. That was most surprising, because one would naturally think that, this being the case, anyone sustaining the slightest wound would die from tetanus. It struck Dr. Fildes as peculiar, and he set to work and found that there were many varieties of the tetanus bacillus, but differing not so much morphologically as in their virulence. That was an important point, and he thought that was why numerous cases of recovery from tetanus occurred in horses. It was taken as a general rule that in man once symptoms of tetanus were shown death was inevitable, but they must all have seen cases in the horse that had recovered and that went on quite satisfactorily afterwards.

Mr. J. W. McIntosh said that he, too, would like to thank Dr. Sheather for giving them that very interesting review of work done in connection with tetanus.

His (the speaker's), experience of this disease, he was glad to say, was not very extensive and was entirely confined to horses. He believed it to be much more common in country districts than it was in large towns. Many years ago, when in country practice, he had many cases of tetanus to deal with and he agreed with Major Taylor that certain farms seemed to harbour the bacillus more than others; in fact, one got to know those farms in practice, and it was advisable to take all possible precautions when dealing with susceptible cases in such areas.

In London it was his experience that tetanus was rare.

In a large stud of horses such as he controlled, which at one period numbered nearly 3,000, he had only three cases of tetanus in 22 years, although these animals were subject to all sorts of injuries in the way of treads, scratches and wounds of all descriptions, so that apparently this bacillus of tetanus did not favour "town life," it preferred "country life." With such a small percentage of occurrences as this it was quite unnecessary to shoe with leathers as suggested by Professor McCunn. It would, in the case of a large stud, be a very costly procedure and on economic grounds alone, could not be recommended. Moreover, avenues of invasion were not confined to the foot, as a slight scratch on any part of the body was almost equally susceptible, if the bacilli were about; in fact, it was his view that it was the least noticeable injury which became the seat of invasion.

With regard to treatment, he had very little success. He had tried the serum, but with little or no appreciable effect. He believed, however, in quietness, a dark, well-ventilated

loose-box and a gag in the mouth to keep the jaws from closing altogether, and thus allowing the animal to suck liquid nourishment. He disapproved of forced exercise, and he could not see how it was possible in acute cases to get movement without the animal falling down in the attempt—and once they got down it was useless to attempt getting them up.

Mr. W. Perryman said that he was sure all present were very deeply indebted to Dr. Sheather for his learned and academical essay that evening, which had engendered a very useful discussion. Nevertheless, he would have liked Dr. Sheather to state more about the general condition of *B. tetani* in the soil because, as so many speakers had said, there were undoubtedly certain areas that were subject to tetanus more than others.

He had seen tetanus in the horse and cow, one case in the pig and one in the dog. It was clearly established, as he had observed, that there was a greater danger of tetanus in some areas than in others, but he had noticed one thing that no previous speaker had mentioned, namely, that the disease occurred in cycles. The most remarkable thing about the disease in his experience was that he was eight years in London before he saw a case of tetanus and then he saw three in eight days, and he had since noticed that if he had a case two or three others followed. It had therefore occurred to him whether there were any climatic conditions that favoured the virulence of the bacillus more than others.

Mention had been made of different types of the disease; he thought if they confined these to acute and sub-acute that was quite sufficient, and he agreed with Dr. McCunn that the symptoms in the acute form were so violent that there was no hope for such cases and that the best thing was to get them out of the way. In the sub-acute form there was a chance and in these he thought care and patience were the great considerations.

He did emphasise one thing in the treatment of these sub-acute cases and that was that the animal should be slung. A recovering animal would sometimes go down and struggle, becoming a case for the knacker in a few hours. He had had that unhappy experience. As to treatment by serum, he believed as a preventative it was good, especially did he advocate it in certain cases of wounds, where there was likely to be any litigation, because there was just the possibility of the opposition asking if the animal turned tetanic: "Was it treated with anti-tetanic serum?" As to the amount of anti-tetanic serum, he did not agree with Professor McCunn that one should give heavy doses. In the sub-acute case, which was the only type he would treat, if one gave too heavy doses—more than 3,000 units—at two or three days' interval, the symptoms became exaggerated whether one gave it intravenously or subcutaneously.

Tetanus was a very difficult disease with which to deal and, honestly, he did not like it, but they were indebted to Dr. Sheather for what he had told them that evening. (Applause.)

Dr. F. C. Minett thought Dr. Sheather had done a useful service in bringing forward a paper of that kind containing gleanings from the literature. He considered that the subject for discussion had been well chosen because it would help to familiarise the society and the profession with the work of Ramon, who, incidentally, was a distinguished veterinarian working on the staff of the Pasteur Institute in Paris.

It was not too much to say that Ramon's work on immunisation had done a good deal towards revolutionising the methods of preparing and titrating antitoxic sera. It had been known for some years that the toxins could be modified by certain chemical reagents, such as iodine, but, as Dr. Sheather had remarked, these methods were only partially good. Ramon had made widely known the great value of formaldehyde for rendering harmless certain toxins, such as that of tetanus, without at the same time altering their antigenic properties. Not only had this proved of great assistance to those engaged in hyper-immunising animals for the production of antitoxic sera, but there had also been introduced into veterinary practice a means of producing active immunity against tetanus, with all its advantages over serum immunity which alone was available in the past. This should be a great boon in areas in which tetanus was of frequent occurrence.

The work of Ramon was of even wider significance than was indicated by what had just been said. There appeared to be no doubt but that his researches had gone a long way towards suggesting the possibility that what was true of toxins might equally be true in the case of filter-passing organisms, that these also might be rendered harmless by formaldehyde and at the same time retain the property of producing immunity in animals. They were now aware that in the case of some virus diseases this possibility had proved to be well founded, with results which would probably be of far reaching practical importance.

Captain F. H. Stainton said that, in view of the action of formalin on tetanus toxin, he would like to know what would be the effect of the intravenous injection of formalin as a curative measure.

The Hon Secretary (Captain Macdonald) observed that he understood Professor McCunn to say that the tetanus bacillus did not function except in the presence of pus organisms. He always understood, however, that the simplest wound was liable to infect an animal with tetanus.

Professor McCunn replied that the reason was that the tetanus bacillus was anærobic and it needed the presence of other bacilli around it to take away the oxygen. Proceeding, he said that on only one occasion had he used anti-tetanic serum as a prophylactic, when he used 3,000 units before castrating a colt which, however, died in three days from acute tetanus. This case was on a farm known as a hotbed of tetanus and sepsis.

Captain W. K. Townson, after expressing his thanks to the essayist, said that no one, in discussing tetanus, had mentioned the frequent occurrence of the disease in lambs. In his district the loss in some years was very heavy. They had treated lambs with anti-tetanic serum, when they had developed tetanus *and* in the early stages.

In no case had he had good results from the use of the so-called curative serum, but he had frequently used the serum as a prophylactic and he believed that in many cases it had done good. With reference to the treatment of horses with the serum as a curative he had never yet had any success. In horses that had recovered from tetanus without any treatment at all, he had noticed that in several cases they had become "shiverers."

As to the use of slings, he thought they had to be particularly careful in choosing the case for the use of slings, as many horses were seriously upset by their use.

He had seen a few cases in the dog and pig, in the latter animal after castration. In his district cinders-ash appeared to be a breeding ground for the tetanus bacillus.

Professor J. G. Wright said that, the discussion having taken on a clinical aspect, might he be allowed to say that no one, so far, had mentioned the magnesium sulphate treatment of tetanus. Major Rabagliati recorded the successful use of this salt in the treatment of tetanus. in two bulls in Egypt (the treatment was introduced, I believe, by Mason). Some held that the daily injection of a saturated solution in doses of 100 c.cs. had a curative effect. As a matter of fact, magnesium sulphate, injected intravenously or subcutaneously, had a rather remarkable narcotic effect; and it was to this, no doubt, that its value was attributable.

Professor McCunn stated that he had tried the use of magnesium sulphate in tetanus, but the pain to which the process of administering the drug put the horse was so great that he thought it was preferable to let the horse die of tetanus.

Major Taylor enquired if anyone present could relate a case on record in which a human being had contracted tetanus from an animal.

Professor McCunn observed that he took it that such a thing was possible, but it was highly improbable.

The President (Professor Macqueen) said that he was rather surprised at the turn the discussion had taken and largely because of the remarks that had been made regarding the curative action of anti-tetanic serum. He did not think that it had been established in practice that anti-tetanic serum had any curative effect. He knew

that cases were reported frequently of wonderful results from so many injections of antitoxin, and the recovery of the animals was attributed to the injections. But there must have been far more cases of tetanus that had not been treated with serum at all that had made excellent recoveries. It would have been more satisfactory, he thought, if they had had an approximate decision regarding the curative action of the serum, and perhaps Dr. Sheather, in his reply, would refer to that point.

With regard to slinging, he believed that a horse suffering from acute tetanus should be slung for the first day or so, because if it went down it would die. As a precaution, it was customary with some practitioners to place the horse in slings, if only for a few days.

Dr. Sheather mentioned the action of stimuli in connection with the French experiments. He (Professor Macqueen) did not deem exercise to be so very audacious as some might think, and he believed it to be worth trying. He had always been sceptical about the treatment usually advised—to keep the horse absolutely quiet. He knew of seven consecutive cases of tetanus which were treated in a loose-box (the same box for all the cases) and in the loft above the loose-box was a gas engine which was going night and day, yet everyone of those horses recovered and without antitoxin. He really thought that the suggestion of the French experimenter, to exercise the horse, was quite a good one. In a sub-acute case the horse usually could walk fairly well, and he thought it would improve if exercise were persevered with. If the animal went down under a sub-acute attack it would get up again with assistance.

There had been some remarks passed about wounds, and in his experience wounds that were most likely to be associated with symptoms of tetanus were those in a condition of cicatrisation, wounds that probably had been suppurating for a considerable time, and had now reached the healing stage—that was when one had the greatest anxiety about the occurrence of tetanus. Wounds of the hind quarters, legs and feet were more subject to be infected by tetanus than any other. The explanation once given was that the *Bacillus tetani* occupied the bowel and was discharged with the fæces. In his early days it was the custom to divide tetanus into two classes: idiopathic tetanus—where there was no discoverable wound, infection arising from the mucous membrane of the bowel—and traumatic tetanus, when the condition was definitely associated with a wound. Another point that had struck him as peculiar was the use of the term "recurrence." It had been stated that an attack of tetanus recurred after an interval of a year. That was not a recurrence; it ought to be called a new attack.

The Reply.

Dr. A. L. Sheather, replying to the points raised in the discussion, observed that he must first say that he could not help feeling a certain amount of gratification in thinking that the discussion on that paper had lasted about twice as long as the reading of the paper itself; he was, indeed, delighted to think that it had been of sufficient interest to raise such a discussion.

He must answer a number of questions by saying that the material he had put before them was not his own work, as was clearly indicated by the title of the paper. It was thus that he must answer Mr. McIntosh, who suggested that he recommended exercise in the treatment of tetanus. He (Dr. Sheather) never recommended anything of the sort, he simply said that someone had twice tried what that person considered an audacious experiment and it had come off.

With regard to tetanus in dogs—"Tetanus is not common in dogs—is usually localised and manifests itself, especially in young dogs, by transitory trismus. In severe cases one is struck by the characteristic facial distortion, the forehead being wrinkled in a sagittal direction, by the rigid erect position and approximation of the ears, the external strabismus of the eyes and the grinding of the teeth, as well as the rigidly-spread extremities; the vertebral column is straight or curved downwards"—that was what Hutyra and Marek had to say on that subject.

Someone mentioned tetanus in cattle; it was rare, but in the past year there had been reference to it in the *Berliner Tierärzliche Wochenschrift.*

The risk of hounds running in and out of places containing tetanus-infected carcasses was infinitesimal, because in cases of tetanus the bacillus was only found in the neighbourhood of the wound itself.

With regard to the duration of immunity, someone mentioned—and he was glad to hear it—that there was an immunity from anti-tetanic serum lasting up to six months. He (the speaker) put it at about 12-14 days and he believed that a valuable immunity was not to be relied upon for more than that period.

He would have liked to have answered all the questions that Mr. Perryman put to him but, as he had said, he was simply reporting on the work of others, so he was afraid he could not go into the questions of virulence, variations of time, season, and so forth.

Concerning infected wounds, he thought it was a fact that if one took a tetanus culture and washed away every trace of the toxin, one could inject as many spores as one liked into an animal and one would not induce tetanus.

Mr. Stainton had asked whether the intravenous injections of formalin were of any value. In cases of Johne's disease he found it of no use, but a very interesting point was that he, quite independently of Professor McCunn, suggested the use of formalin in dogs for the acute dysenteric condition seen in greyhounds, three months before Professor McCunn said anything to him about it. It was an entire success.

He did not suppose that there was a recorded case of a human being contracting tetanus from an animal, because it was not an inoculable disease in the ordinary sense of the term.

With regard to the President's statement about tetanus occurring when wounds were cicatrising, he thought the explanation of that was that the original infection with tetanus was probably a light one, and it was only after a certain length of time that the bacillus produced sufficient toxin to yield the symptoms of the disease, and by that time the wound was cicatised.

He was delighted to get the President's support for the "audacious experiment." He presumed that the man was taking a risk when he did it, and he also supposed that the man would not have taken the horse out if it looked like going down. However, he certainly thought it was a thing that should be tried.

He must thank them very much for their patient hearing of him; he never dreamed that he should be able to keep them interested for such a length of time. (Applause.)

Lancashire Division's Summer Meeting.

The members of the Lancashire Division are looking forward to having an interesting Summer Meeting on Friday, July 18th, at Chester. A number of demonstrations have been arranged and these will take place at Mr. J. Storrar's Veterinary Establishment in Newgate Street. Although the programme is not yet completed, the following have been promised definitely: (1) Vaccination for fowl-pox (roup, etc.); (2) lavage of the alimentary canal of the dog; (3) the use of the bovine embrytome; (4) the intradermal tuberculin test; (5) caponising; (6) the stomach tube for horses; (7) intravenous medication; (8) the normal ophthalmascopic picture of the horse's eye.

It is possible that if material is available other operations will be carried out, such as Burdizzo castration, and castration of a cryptorchid.

Animal Breeding Research.

The formal opening took place on Monday of the new animal breeding research department of Edinburgh University. An address, in which he made a vigorous defence of vivisection, was given by Professor Sir Edward Sharpey-Schafer. Occasion was also taken to confer the honorary degree of LL.D. upon Mr. T. B. Macaulay, President of the Sun Life Assurance Company of Canada, who some time ago endowed a lectureship in the department for the encouragament of research directed towards human physiological problems.

Writing for Publication.*

By. Lieut. Maurice W. Hale, U.S. Army Veterinary Corps.

Many members of the veterinary profession do not possess the art of writing and have been too busy to acquire its usable substitute, the craft of writing. Since these men are asked to contribute professional papers or addresses from time to time there is need for a few short, condensed rules and essential points in order that busy men may be helped in their writing with the least possible effort or delay. With this in mind, an attempt has been made to collect some very general subject matter without including any of the specifically technical points of writing. No effort has been made to make this work original, and material has been drawn freely from various sources.

Subject Matter and Length of Papers.

The writer should choose his topic from the most available subject of which he has made some original study and, what is of greater importance, he should choose it from material of which he may have an opportunity to make further studies and investigations.

The surest means of gaining the recognition of professional associates and of adding somewhat to the sum total of scientific knowledge lies in the thorough and persistent study of a single subject rather than in short, hasty studies of many subjects. In a series of articles giving the results of continued observations on the same topic, material already published should not be repeated.

To recommend that the writer choose a subject which he knows well is not so superfluous as it seems. What is well known seems commonplace and only the unfamiliar allures. But obviously the unfamiliar must be left to someone to whom it is familiar.

A paper should be brief and clear, demanding only enough of the time and patience of the reader to permit the presentation to him of the essential points. Should an article necessarily extend beyond five thousand words, it may be wise to publish it serially. If published serially, an opportunity is afforded for a more complete investigation of the subject.

Arrangement.

In the plan of the construction of an article, the end should be considered with the beginning and both should be kept in view during the course of the work for purposes of logical finality. The safe course for the inexperienced writer is to state his problem, his observations, and his deductions briefly and clearly, and then stop without hesitation. Some fixed rules should be adhered to—begin promptly; bring the argument to a climax at the end of the paper; summarise briefly; end promptly.

The Outline.

The importance of making a complete outline will always be appreciated after it has once been done. While outlines must be varied according to the subject under discussion, the following may be adapted to almost any scientific subject:—

1.—*Introduction.*—This should give the object of the paper, the character and extent of the original data to be discussed, and the sequence of the article, if it is one of a series.

2.—*Historical Notes.*—The literature of the subject should be reviewed. The writer should summarise the views of other workers in the same field and then restate briefly his own previous studies, if any.

3.—*Material and Methods.*—This should include an exact statement of the character and amount of the material investigated, of the old and new method of investigation, and of the operations and devices used.

4.—*Results.*—Here should be a detailed discussion of the results of the investigation, operative procedures or experimentation. While those findings which tend to prove the writer's hypothesis should be given first place in the paper, negative findings and those of no apparent significance should also be stated.

5.—*Summary and Conclusions.*—This is an important feature of all papers, in that a voluminous literature may be hurriedly checked over and the essence of the papers obtained by reading the summaries alone if they are properly written. A good summary and conclusion will serve as the most desirable form of abstract to be published by other journals. It should include a brief review of the work done and the conclusions which may be drawn properly therefrom.

Construction.

The successful writer will mould his writings in such a manner as will interest and please the reader. His writings will be characterised by:—

1.—A careful avoidance of exaggerating his personal observations and of minimising the observations of others.

2.—A precision in the use of words.

3.—An orderliness of construction in arranging clauses, sentences, and paragraphs and in making all statements brief and clear.

4.—A logical sequence of facts, theories, and deductions which will stimulate and inspire the reader to a desire for further investigation of the same subject.

Revision.

The writer who appreciates his own limitations will be his own most severe critic and thus will find ways and means to improve his work. The importance of careful revision of each paper before submitting it for publication should not be ignored. The clean typewritten manuscript should be read carefully several times, giving special attention to the following points:—

1.—Changes in the arrangement of material. Few changes should have to be made, if the outline has been properly made and exactly followed.

2.—Proper placing of tabulations and subheads and a uniformity of arrangement throughout.

3.—The addition of data, ideas, and missing links in the argument. In this portion of the work much care should be taken in eliminating inaccuracies, in expanding incomplete statements, in verifying data and statistics, and in correcting proper names, dates, and so forth.

It is a good rule to revise the manuscript several times, then put it aside and revise it again later.

The Title.

The title of a paper should set forth the character, and if possible, the extent of the article. It should be a brief index of the material under discussion. When this point is overlooked or neglected by the writer, the editor should insist that a proper title be supplied. Remember that

*Reproduced from the *United States Army Veterinary Corps Bulletin*, Vol. xxv, No. 4.

first impressions are strong impressions. Therefore a title ought to be well studied and give, as nearly as possible, a precise indication of what is to come.

THE MANUSCRIPT.

The manuscript should be typewritten on but one side of a good grade of white paper, with double spacing between the lines. A margin from one to two inches should be reserved on the left of the page in which to make notations and corrections. A carbon copy with which to compare the publisher's proof should be retained by the author in case of accident, or loss of the original manuscript. The *original copy* should be sent to the publisher. Consecutive numbering of pages should be maintained throughout the article. At the top of the first page, in large capitals, should be the title of the article. Centred underneath, in small capitals, should be the author's full name, his degrees, and any positions he may hold. At the bottom of the first page should be a footnote giving the date of submitting the paper for publication.

SUMMARY.

" The four rules for the preparation of an article for a journal will then be: (1) Have something to say. (2) Say it. (3) Stop as soon as you have said it. (4) Give the paper a proper title."—*Billings.*

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The Horse and Agriculture.

" The state of the agricultural industry, indeed, is intimately linked with the demand for industrial horses," says *John Bull.*

" The National Veterinary Medical Association has shown that if we assume the annual cost of feeding and bedding a horse to be £40, then the presence in this country of 300,000 industrial horses would create a market for £12,000,000.

" The continued revival, both in the employment of horses and in their breeding, may, therefore, have interesting repercussions in the dejected agricultural world."

The Dog Show at the Fourth World's Poultry Congress.

One of the special features at the World's Poultry Congress will be the Dog Show to be staged by the Dog Owners' Club, with the approval of the Kennel Club, in the Canada Building at the Crystal Palace, on July 29th and 30th. The Club approached the Ministry of Agriculture, which is organising the World's Poultry Congress, with the suggestion that the delegates and visitors of the sixty nations to be represented at the Crystal Palace will probably take great interest in a display of the best British dogs. The Ministry was glad to accept the suggestion.

The exhibition, of which the President is the Right Honourable the Earl of Chesterfield, K.G., will be open free to visitors to the Crystal Palace; but for certain special displays in the arena, by trained Alsatians and other dogs, there will be a charge for seats. The judges of the Training Classes will be Lady Kitty Ritson, Air Vice-Marshal Lambe, C.B., C.M.G., D.S.O., and Mr. de Pinto. There are 54 classes in the exhibition and the entry fee is 10s. 6d. for each dog, with a reduction of 2s. to members of the Dog Owners' Club.

Clinical and Case Reports.

Pre-Parturient Eclampsia in a Sow.

By C. B. Davidson, M.R.C.V.S., Senior Clinical Assistant, Royal (Dick) Veterinary College, Edinburgh.

This case was treated before the arrival of the *Veterinary Record* in which Mr. Hepburn, of Aberdeen, recorded a similar case.

On May 15th, 1930, I was called to see a sow which was perfectly well at 10 a.m. The man in charge said that an hour later she was " taking fits, and had been dashing her head against the wall just as though she was mad." She was a sow of about 3 cwts., in fine breeding condition, and due to farrow two days later, May 17th.

On attendance, she was found lying on her side and an extensor tetany was present in all four legs. The corneal reflex was rather duller than normal; temperature 99·2° F., and the bowels quite normal. She was jostled and made frequent attempts to rise, but was unable to do so.

One hundred-and-twenty-five c.cs. of calcium gluconate (Sandoz) solution were given subcutaneously. Only a 2-in. hypodermic needle was at hand, and it was found impossible to get it to penetrate the thick skin of the body. The injection was, therefore, given in the loose skin behind the ears. Within two minutes the skin over the area injected became red. She rose to her feet within 15 minutes, and, although a little staggery, was able to walk across her rather large box. She was then given 4 ozs. of an oleaginous laxative with 2 drachms of chloral hydrate. Three hours later she was reported normal.

When seen on May 17th, she appeared quite normal, but had not farrowed, and the skin over the injected area was dull blue and looked as though it might slough.

The next day she gave birth to 16 piglings, and when examined on May 19th the skin behind the ear where she had been injected showed desquamation of the epithelium, but the underlying true dermis appeared healthy, though moist.

My only reason for prescribing the chloral hydrate was in case the calcium failed to act, and it is interesting to note that throughout the remainder of the day the sow never became dull or showed other effects which might have been associated with the hypnotic.

A Severe Case of Canine Piroplasmosis.

By J. S. Cowin, M.R.C.V.S., Government Veterinary Officer, Moshi, Tanganyika Territory.

Subject.—A 12 months old, imported, Alsatian bitch.

History.—This bitch had had distemper rather badly about two months previously, but recovered after running a high temperature for several days.

On April 2nd she was brought to me in a weak state with arched spine and notable weakness of the hind limbs. Her temperature was 103·5° F. I was undecided as to whether the disease was trypanosomiasis or canine piroplasmosis, but a thin blood smear revealed a heavy infection of piroplasms with as many as four parasites to a

corpuscle in some cases. There was a good deal of fluid in the abdominal cavity in the region of the liver, but I did not bother about that, having diagnosed piroplasmosis.

Treatment.—She received 10 c.cs. of a 2 per cent. solution of trypan blue at once, injected subcutaneously on the inside of the thigh, and I informed the owner that I expected to see an improvement inside 24 hours.

Subsequent History.—On April 3rd I went to see her in the afternoon and found her much worse. The abdominal fluid had increased in quantity and moved backwards. A distinct systolic heart murmur could be heard with the stethoscope and the heart was pounding in a most distressing manner. There was a well-marked jugular pulse and œdema of one hind limb. All visible mucous membranes were deeply stained with the trypan blue. Some of the abdominal fluid was withdrawn by means of a trocar and canula and it, too, had a bluish tinge; this treatment afforded some relief. The owner was given a mixture of tincture of digitalis and potassium iodide and told to give it every four hours after laxative treatment. A blood slide taken at this stage showed that the parasites had disappeared from the circulation.

Post-mortem.—Next morning the dog was dead and on *post-mortem* the spleen was found to be enormously enlarged. There was a quantity of blood-stained fluid in the abdominal cavity, but not so much as I expected to find; apparently the huge bulk of the spleen gave rise to some of the *ante-mortem* appearance. The liver was enlarged and congested, and the kidneys showed congestion of the pelvis. The right auriculo-ventricular opening of the heart was dilated. The lungs were normal except for a little congestion of the bases.

Conclusion.—It is probable that the injection of trypan blue in this case hastened the end by destroying red blood-cells at the time the parasites were destroyed and producing an anæmia, thus imposing a greater strain on an already diseased heart.

Hepatic-Diaphragmatic Adhesions in a Mare.

By J. E. Barnes, M.R.C.V.S., Colombo.

I give herewith an account of a peculiar case I came across some months ago, which may be of interest to your readers.

Subject.—Thoroughbred mare, aged.

Symptoms.—At the walk, she moved normally and walked well. Trotting slowly, she moved fairly well but made grunting and groaning noises, which increased with pace.

When made to canter she was unable to extend herself at all—she seemed as though she was going to fall on her head and emitted tremendous groans.

History.—She had suffered some months previously from a "chill." She had not made a good recovery and as she was not "doing" she had been sent out of training and had been doing walking exercise, led in hand. With this treatment she improved, and when I saw her she had been sent back to training.

Post-mortem.—Eventually, however, a *post-mortem* had to be made, when the findings were these: Liver slightly enlarged, with, on the diaphragmatic surface, some increase of connective tissue. The liver, in several patches, each one as large as the palm of one's hand, was adherent to the diaphragm.

Abstract.

[**Actinomycosis common to Man and Animals.** Discussion at a Joint Meeting of the Sections of Comparative Medicine and Surgery, the Royal Society of Medicine, *vide Proc. Royal Society of Medicine,* April, 1930.]

The discussion was opened by Dr. L. Colebrook. He commenced by considering the use of the term "Actinomycosis" in the light of present-day knowledge. The pathological conditions included in both human and veterinary medicine under the term "actinomycosis" may be described as chronic, localised, suppurative processes, or granulomata. They are met with usually in the form of nodules, abscesses and fistulæ and a diagnosis of actinomycosis is usually made by the naked-eye observation that the pus contains "sulphur granules." An attempt to classify this heterogenous group of clinical conditions presents difficulties at once.

The group of organisms responsible for these conditions is a large one and many are difficult to cultivate. In the following table an arbitrary distinction is made between the infections which produce granules bearing clubs and those which do not.

Table.

The term "actinomycocis" may refer to:—

I.—*Infections associated with granules bearing clubs,* and due to:—

(1) *Actinomyces bovis,* anærobic type (Wolff-Israel).
In man: Jaw, thorax, abdomen.
In cattle: Jaw, udder.

(2) Mycelial organisms distinct from *A. bovis.*
In man: "Madura feet" and miscellaneous cases (Wynn, Cohn, etc.).
In cattle: (?).

(3) Actinobacillus of Lignières and Spitz.
In man: One case reported; (?) others.
In cattle: "Woody tongue" and skin lesions.

(4) Staphylococcus.
In man: (?).
In cattle: udder (cow and pig).

(5) *Bacillus pyogenes.*
In cattle: Lesions of jaw, etc.

II.—*Infections by mycelial organisms, but showing either no granules or granules not bearing clubs,* due to:—

(6) Unclassified organisms (streptothrix).
In man: Miscellaneous cases, reported by Birt and Leishman, Henrici and Gardner, etc.
In cattle: Miscellaneous cases, *e.g.,* those of Siberschmidt, Nocard and others.

Of these groups, there has been a steady growth of bacteriological opinion during the last 25 years that the well-defined anærobic organism *Actinomyces bovis* of Wolffe and Israel is responsible for most cases of human infection associated with granules and clubs, and the three chief sites of the disease are about the jaw and neck, the thorax and the abdomen.

The third group, infection by the actinobacillus of Lignières and Spitz, is a common disease in cattle, but, so far as the speaker knew, only one case has been recorded in the human subject—a case of meningitis.

About the fourth and fifth group there is some difference of opinion. It is claimed by some veterinary bacteriologists that there is a form of actinomycosis in the udder of the

cow and the pig, in which neither mycelial organisms nor the actinobacillus is present, but that the granules are a dense mass of capsulated staphylococcus. These infections appear to be analagous to the so-called botryomycosis in the horse.

Such a staphylococcus infection in man has been described in at least one instance.

In Group 5, met with in animal pathology and associated with jaw lesions in cattle, the lesions have yielded another potential club-former, *B. pyogenes*.

At this point the speaker points out that the continued use of the term actinomycosis to cover all these different infections is unfortunate, and that this term should only imply an infection by a filamentous organism which forms in the body definite bacterial colonies surrounded by a radial arrangement of clubs.

Amongst the names in Dr. Colebrook's suggested nomenclature occur :—

Actinomycosis, due to infection by *A. bovis*.
Actinobacillosis, ,, ,, ,, the actinobacillus.
Actinophytosis, ,, ,, ,, staphylococcus.

Continuing the discussion, Mr. Zachary Cope said that the common form of actinomycosis in man is caused by a gram-positive anærobic hypomycete, similar to the organism described as causing the disease in cattle. The first problem of interest to the surgeon is that of the origin of the fungus. What is its habitat and how does it reach the tissues? Recent work carries conviction that it is a common, if not usual, inhabitant of the mouth and resides in many carious teeth. There is no difficulty in understanding how slight abrasions of the cheek and gums will enable the fungus to enter the tissues, nor is it any cause for surprise that the cæcum and appendix should contain swallowed portions of mycelium. Similarly, aspirated fragments might account for the pulmonary lesions. In spite of the fact that cases occur in which a direct connection may be traced between barley and other grains and actinomycosis, further investigation is needed since no anærobic fungus of a similar nature has been isolated from this source.

Concerning the conduct of the actinomycosis fungus in the tissues of the body, there are three points which are peculiar and characteristic. The first, the way in which the process advances by contiguity of tissue. The second, the curious immunity of lymph glands to the infection (this feature is in sharp contrast not only with actinobacillus infection of cattle, but also with other varieties of infection, both acute and chronic). Thirdly, the remarkable reaction which the fungus causes in the connective tissues.

Diagnosis is only made with certainty by finding the granules in the pus or by seeing them in sections of the tissue. The granules must be examined microscopically and show the typical gram-positive mycolin and, preferably, clubs also. All débris can closely simulate the naked-eye appearance of a fungoid granule.

Prognosis varies greatly according to the part affected. The most favourable part is the cervico-facial region, where the majority become healed in the course of time.

Less favourable is the outlook in ileo-cæcal actinomycosis. In thoracic cases results vary according to the amount of tissue involved.

Referring to treatment, Mr. Cope mentions that there is no specific for actinomycosis comparable to salvarsan for syphilis. The administration of iodine in one form or another often gives good results, but how much the cure is due to the drug is difficult to determine. X-rays have a softening influence on the hard mass of inflammatory tissue. Radium is less certain. Specific therapy, by means of vaccines, has been tried, but results have not been striking.

Surgery has a definite sphere in the opening of abscesses, in the removal of sequestra and dense connective tissue.

Mr. T. J. Bosworth (Institute of Animal Pathology, Cambridge), dealt with the pathology of the disease from a veterinary aspect. There are, he said, at least three distinct types of infection in animals to which the term actinomycosis is somewhat loosely applied. Lesions of the tongue, pharynx and glands of the head in cattle are almost invariably due to the actinobacillus, whilst *Actinomycosis bovis* is to be suspected in cases where the jaw bones are affected and the regional lymphatic glands are not involved. The third, chronic staphylococcus infections in which colonies are present, and to which the term botryomycosis is applied.

Reviewing the situation as far as the various domesticated animals are concerned, Mr. Bosworth stated that the bovine species is affected much more frequently than any other and is subject to each of the three diseases mentioned.

A. Actinobacillocis.—Affects, in a high percentage of cases, the head and the upper part of the neck and is often confined to this region. Occasionally it affects the skin, and also the internal organs, the walls of the stomachs and intestines, the lungs, liver and serous membranes. In contrast to *Actinomyces bovis*, it invades the soft tissues and tends to spread by way of the lymphatics. It is rarely found in bone. The primary lesions usually occur in the tongue, gums, pharynx, hard palate, etc., and infection quickly spreads to the lymphatic glands, which tend to become enlarged. In advanced cases they are converted into fluctuating abscesses, filled with thick, glutinous, greenish-yellow pus, in which the granules are abundant.

The actual organism cannot always be distinguished with certainty under the microscope, as it is largely obscured by the amount of débris present; it can, however, be recovered quite easily in culture.

Actinobacillosis may be diagnosed in the living animal by the agglutination test, and this is of practical value as a means of distinguishing the condition from tuberculosis when considering the desirability of initiating treatment.

B. Actinomycosis.—The common form in cattle commences as an infection of the jaw-bone. A primary lesion in other situations is probably extremely rare. Infection probably gains entrance through the alveoli in many instances, or it may reach the periosteum through an ulcer of the gums. It sets up a chronic suppurative inflammation, resulting in destruction and rarefaction of bone and its replacement by granulation tissue containing purulent foci. At the margin, new bone is produced and the combined processes lead to considerable enlargement of the jaw. The pus is of a much thinner consistency than that of actinobacillosis and the granules are usually larger and show a great tendency to spread by way of the lymphatics.

A number of attempts have been made to reproduce

actinomycosis experimentally; most of these have failed entirely.

C. Botryomycosis.—Is occasionally observed in the cow's udder. It was formerly regarded as actinomycosis owing to the presence of granules with clubs. These, however, consist of masses of staphylococci.

Dealing with swine, the speaker said that the mammary glands are most commonly involved and lesions elsewhere are comparatively rare. In Sweden, where the condition is prevalent, 181 cases were found to be actinomycosis and 41 botryomycosis.

In the horse, actinomycosis is only occasionally seen, the commonest sites being the head and the spermatic cord. Further investigation is necessary, as it is by no means certain that *Streptothrix israeli* is the ætiological factor. Botryomycosis is well-known in the horse. The typical granules present in the pus are devoid of clubs and consist of masses of staphylococci surrounded by a narrow zone of acidophile material of homogeneous appearance.

Lesions of the type under discussion are absolutely rare in other species of animals, but actinomycosis, or at least streptothricosis, has been reported in dogs and cats, and actinobacillosis in sheep.

Other speakers referred to the surgical aspect of actinomycosis in the human subject, and also surgical interference combined with iodine medication. In this latter connection, some of the doses of potassium iodide mentioned are of interest. Whilst 75-100 grains daily are not uncommon doses, cases were mentioned in which 480, and even 800 grains had been given.

On the veterinary side, but for a passing reference by Mr. G. Dunlop Martin to biniodide of mercury, no mention was made of treatment.

J. G. W.

Encephalomyelitis in the Fox.

C. Levaditi, P. Lépine and J. Bazin (*C. R. Soc. de Biologie,* January 24th, 1930, p. 136) have met with two cases of encephalomyelitis in foxes. The first animal had been imported from Canada in December, 1928, and began to show symptoms of illness in July, 1929. The second animal was born and bred in France, and became ill in August, 1929, when six months old. Both animals were silver foxes, and both died. Histologically the cortex of the first animal showed encephalitis and perivasculitis; the vessels were surrounded with lymphocytes and mononuclear cells; there was proliferation of the microglia, chromatolysis, and deformation of the cortical neurones; the medulla and cord were free from lesions. In the second animal there was a mononuclear meningitis, and foci of cortical encephalitis without any definite perivasculitis were seen. There were polymorphs in the vessels, perivascular hæmorrhages, chromatolysis, and intense vacuolation of the neurones. Experimentally the authors were able to reproduce the disease in a wild fox by intracerebral inoculation with virus received from America. The incubation period lasted 78 days and the illness 12 days, after which the animal died. A necropsy revealed the presence of encephalomyelitis. It would appear, therefore, that the American virus may be virulent for European foxes.—*British Medical Journal.*

Sir George Bowen, presiding at a meeting of the Council of Agriculture for Wales at Shrewsbury, said in Wales this year they had no cause to complain of the money they had received for their live stock, all classes of which had been selling remarkably well and had certainly been a paying proposition. Higher prices had also been obtained during the year for horses, sheep and pigs.

Reports.

Southern Rhodesia—Report of the Director of Veterinary Research for the Year 1929.

During the year 1929 the limited staff, consisting of two qualified veterinarians, *viz.,* the Director and one Research Officer, assisted by a small lay staff, has been chiefly occupied in routine and clerical work. Commenting on the overwhelming burden on the administrative side, the Director says " It is impossible to supervise the general routine work of the office and station, and attend to correspondence and interviews, control the preparation and issue of vaccines and the inoculation processes, and at the same time carry out detailed research into sheep diseases, trypanosomiasis, horse-sickness, red water and gall sickness or the many other ailments which, in the public interest, should be thoroughly investigated and overcome. Anyone of these subjects would provide a whole-time worker with more than ample food for time and thought. Innumerable obstacles have also stood in the way. The accommodation provided by the station, which is less than 100 acres, is insufficient. Where there is any grazing it is overstocked, and in the dry seasons animals would starve if rations were not purchased for them. This prevents the carrying out of observations on an adequate scale."

In spite of these obstacles, time has been found for several interesting pieces of research into a number of diseases. A considerable portion of the report is devoted to the progress of research into trypanosomiasis. The method of immunisation introduced by the Director in 1909, namely, the deliberate infection with a strain of known strength followed by treatment with a suitable trypanocide at the right moment, has continued to give satisfaction. Further investigations have been undertaken, with special reference to a modification of this method which will bring about a condition of tolerance or resistance in cattle, and thus enable them to live in " fly " areas.

In one experiment, six inoculated and six control animals, which were submitted to natural infection, became infected not only with *T. pecorum,* but also with *T. vivax*; they were treated with antimony, etc., but failed to improve. At first, this was attributed to the severity of the mixed infection, but subsequently it was found that the animals were extensively infested with *H. contortus.*

Later experiments have indicated that *T. vivax* is not resistant to antimony; moreover, the local *T. vivax* infection reacts to treatment in exactly the same way as *T. pecorum, i.e.,* the parasite is not entirely destroyed, but the animal is rendered tolerant. Such " premunised " animals remain in good condition in " fly " areas. Experiments were also undertaken to determine whether a mixed infection with *T. vivax* and *T. pecorum* would give rise to a more acute disease, but no such evidence could be deduced. Various trypanocidal drugs were also tested, with particular reference to preparations which would be efficacious by the subcutaneous route; a Bayer product, "Antimosan," gave promising results.

Lawrence has made some investigations into the vermicidal action of iodine against the alimentary parasites of the sheep and has reached the conclusion that whilst Lugol's solution is very efficacious *in vitro,* the amount of iodine

which would be required in a sheep would be excessive. Amongst other diseases of sheep quarter-evil is more common than is generally suspected. It does not always manifest itself by muscle lesions, but more frequently assumes an intestinal form. Bevan suggests that in some respects it resembles certain forms of "braxy" or "struck"; it is prevented, however, by the quarter-evil vaccine.

Distomatosis is becoming more prevalent, but readily yields to treatment, extract of male fern and carbon tetrachloride having been found efficacious. A curious disease of cattle in the Marandellas district, characterised by nasal catarrh, conjunctivitis and blindness, was attributed by Lawrence to a vegetable poison which has not yet been exactly identified.

Laboratory Products.—Vaccines and other laboratory products to the value of about £1,000 were issued during the year, and were sold at a price little above the cost of production. About 70,000 doses of quarter-evil vaccine were issued; on the other hand, there was little demand for redwater and gall sickness vaccine, which is intended for the inoculation of (1) calves on areas freed from ticks by long continued dipping; (2) animals imported from overseas. The inoculation of calves has been practised for many years with excellent results, but the application of the vaccine to older animals for whom it was never intended has been followed by unfavourable results for which the vaccine has been unfairly blamed. As an illustration, 34 locally-bred bulls from tick-free farms were inoculated experimentally; the reactions which followed were very severe, showing the paramount necessity of inoculating the animals on "dipped" farms as calves.

Owing to the diminution in the number of horses and mules, there was little demand for the horse-sickness vaccine. During 1929-30, 322 protected police horses were exposed to infection with a death rate of 9 (? 6), and out of 44 horses which were inoculated with the vaccine, 3 died; these figures compare very favourably with previous years.

In spite of the lack of interest with which infectious abortion is regarded by the stock owner, 5,000 doses of the special "devitalised" vaccine were issued. As in previous reports, Bevan stresses the possibility of the transmission of this disease from cattle to man with the production of an undulant type of fever.

The total sum provided for the department for the year was £6,580, but the sale of vaccines, animals, etc., yielded a sum of £2,198, so that the cost of veterinary research to the country was less than £5,000.

R. E. G.

Southern Rhodesia. Report of Chief Veterinary Surgeon for the Year 1929.

The Veterinary Department, at the end of the year 1929, was composed of 12 veterinary surgeons under the direction of Mr. J. M. Sinclair, M.R.C.V.S. (C.V.O.); they have been fully occupied throughout the year in investigating and dealing with the various stock diseases, and in general work such as the inspection for exportation of live stock and of meat, the application of tuberculin and mallein tests and so on. In addition to the veterinary officers, 94 cattle inspectors were employed, of whom 44 were engaged on East Coast fever work, but by the end of the year the number of the latter was reduced to 27.

The highly efficient work of this staff is reflected in the fact that, with the exception of an unexpected outbreak of East Coast fever and an increased mortality from heart-water, the year was remarkable for its freedom from cattle diseases. The year was also notable for the introduction of a new policy in dealing with East Coast fever, which came into force in May. Where definite outbreaks occur, it is now laid down that infective animals have to be slaughtered and compensation paid to the owner to the extent of 75 per cent. of the value of the cattle. It is noted that the mortality in extensions from original outbreaks has been very low owing, no doubt, partly to early diagnosis and partly to intensive supervision around existing infected areas. There was a marked decrease in the incidence of anthrax and quarter-ill; this was largely attributable to the increased use of the appropriate vaccines, which are regarded as highly efficacious. No outbreaks of tuberculosis were diagnosed; at the abattoirs, however, two cases of tuberculosis in 3,081 carcasses examined for export to the Belgian Congo were detected. In addition, 1,475 imported cattle were tested by the subcutaneous method; four of these failed to pass the test and were slaughtered.

Whilst satisfactory progress is being made in the control of these diseases, heart-water is on the increase. This was attributable to the spread of the bont tick through exemptions to dipping granted on account of the drought, and for similar reasons cutaneous myiasis was very prevalent during November and December. Trypanosomiasis and distomiasis were also widespread in certain districts. The Report is signed by G. C. Hooper Sharpe, Acting Chief Veterinary Officer.

R. E. G.

The Origin of Antitoxins.

G. Ramon (*C. R. Soc. de Biologie*, October 25th, 1929. p. 287) discusses the various explanations that have been offered for the method of formation of antitoxins. The original hypothesis put forward by Buchner, that antitoxin represented a simple modification of the toxin, has been abandoned by most workers on account of the difficulty in reconciling certain observations with it. One of the most important of these is that, if an animal which has been inoculated with a given toxin is bled copiously, the antitoxic titre of the blood may rise without any fresh injection of toxin. Though this observation has been made independently by several workers, Ramon doubts it. His experience has been that, provided a sufficient length of time is allowed to elapse between the last injection of antigen and the first of the series of bleedings, the effect of the bleeding is always to lower the antitoxin titre of the blood. He has come to the conclusion that no production or increase in antitoxin can take place independently of the presence of the antigen. His general idea of the formation of antitoxin is as follows: the antigen, on gaining access to the body, undergoes dissociation of a variable degree, due probably to the action of cellular and humoral ferments; as the result of the interaction between the antigen and the body tissues an antitoxin complex results, the specificity of which depends on the persistence in the complex of a chemical nucleus derived from the antigen.—*British Medical Journal.*

Divisional Report.

Central Division, N.V.M.A.

Tetanus Discussed at Red Lion Square.

A Remarkable Exhibit.

Attendance at the Annual Meeting of the R.C.V.S. in Dublin effected a marked reduction in the numbers present at the last meeting of the Central Division, which was held at 10 Red Lion Square, W.C.1, on Thursday, June 5th, with the President (Professor James Macqueen) in the chair. The meeting, however, proved notably successful, thanks to an admirable paper by Dr. A. L. Sheather, entitled "Some Extracts from Recent Literature on Tetanus," which stimulated one of the best-sustained discussions of the session.

[Dr. Sheather's paper, and the report of the discussion, are reproduced at the commencement of this issue of the *Record*.—Ed.]

The following were present: Professor James Macqueen, Messrs. W. Brown, H. E. Bywater, I. H. Galloway, D. Johnston, Major H. Kirk, Mr. G. H. Livesey, Captain G. Dunlop Martin, Professor James McCunn, Mr. J. W. McIntosh, Captain F. W. Medlock, Dr. F. C. Minett, Mr. W. Perryman, Major F. S. Probyn, Dr. A. L. Sheather, Mr. A. Sillars, Mr. F. H. Stainton, Major F. J. Taylor, Captain W. K. Townson, Professor J. G. Wright and Captain J. F. Macdonald (Hon. Secretary).

The minutes of the April meeting of the Division, having been published in the *Record*, were taken as read and were confirmed.

The Hon. Secretary announced the receipt of apologies for absence from Lieut.-Colonel E. P. Argyle, Major-General Sir John Moore, Captain S. J. Motton, Mr. H. L. Roberts, Lieut.-Colonel P. J. Simpson, Mr. E. Lionel Stroud and Mr. Mark Tailby.

Obituary.—The President observed that he regretted to have to inform the Fellows that since their last meeting they had suffered the loss of one of their number, Mr. Joseph Stephens, of Finsbury Park. He had no doubt that they would remember him as a fairly constant attender at their meetings and social entertainments. Mr. Stephens was a wonderfully courageous man considering his disablement, and he (the President) might say that when, quite late in life, Mr. Stephens entered as a student at the Royal Veterinary College, he succeeded in obtaining his diploma in record time.

He thought they should signify their respect for Mr. Stephens in the usual way.

The Fellows stood for a moment, in silent tribute.

Nomination for, and Elections to, Fellowship.—Captain J. B. Walker, of High Street, Slough, and Major T. Hicks, of Sleaford, were nominated for Fellowship, and the elections as Fellows of the Society were unanimously made of Mr. S. E. B. Balfour-Jones, of Brighton (Proposer, Captain Stow; Seconder, Mr. Bullen); Mr. S. E. Holmans, of Bromley (Proposer, Professor McCunn; Seconder, Principal Hobday) and Mr. Donald Johnston, of Woking (Proposer, Captain Medlock; Seconder, the Hon. Secretary).

Exhibit.

Major Hamilton Kirk said that he had brought for their inspection some cystic calculi (removed from an Airedale bitch) which, in point of size and numbers, he believed constituted a record.

The bitch was six or seven years of age and the history was that she squatted down continuously to urinate, although able to pass only a few drops at a time. Palpation through the abdominal wall revealed in the bladder a foreign body, which he regarded as a stone, and in view of the irritation already present, he thought an operation should be performed as quickly as possible, *i.e.*, before cystitis became severe.

Being single-handed, he asked Professor Wright to help him with the operation, which they realised would assume rather serious proportions, and between them they managed to effect a successful result. Without Wright's very valuable aid he was sure this would not have been possible. Anæsthesia was by morphia and chloroform, and in order to remove the largest stone a 2½-in. incision had to be made through the bladder wall. The big stone weighed 6¾-oz., beside which there were 273 of a size too large to pass, or which would have caused considerable pain in doing so. Finally, there were 1,300 minute stones. The bitch went to her home after a week in his hospital, and to-day was perfectly recovered.

Dr. Sheather remarked that he wondered whether diagnosis of stone in the bladder might be facilitated by filling the bladder *via* the urethra, with the bismuth that was used in taking X-ray pictures in the human subject.

Major Kirk said that he always understood that if a foreign body such as a bone or stone were present, X-ray would reveal it without the aid of bismuth.

Professor McCunn said that Major Kirk was somewhat in error, in that all foreign bodies did not show up under X-ray, and that was particularly so as regarded urinary calculi. The oxalate calculi did not show, or if they did, only very faintly; the others showed quite distinctly. At that moment he had forgotten the name of the bismuth fluid used in human surgery to reveal cystic obstructions. It was injected up the urethra into the bladder, and any foreign body not otherwise visible under X-ray showed up as a white substance.

The same fluid was used to take photos of the renal pelvis. If one got a good photo one could see the renal pelvis, the ureter, the bladder and the urethra—their shape and whether or not there were filling defects in evidence.

Dr. Sheather stated that he knew well that mistakes were made in the reading of X-ray photographs. A friend of his who, as the result of a war wound, still suffered from the periodic accumulation of pus in his chest, was X-rayed on one occasion because he felt that the pus was accumulating. The report on the photograph was "no evidence of pus." Within 24 hours 1½ pints of pus escaped through a sinus in his back.

The Hon. Secretary (Captain J. F. Macdonald) stated that he thought there was no doubt that tetanus did occur in the dog. He had seen at least one case which presented all the clinical symptoms of the disease—fixation of the jaws, poking of the head, etc., and it made a complete recovery.

Concerning the freedom of foxhounds from infection after the ingestion of tetanus-infected flesh, after all, the infection in tetanus was limited to a local area and the fox-hounds, in eating the flesh, probably would not be picking up the germ itself but only a certain amount of toxin.

Professor Wright agreed with Professor McCunn with regard to the diagnosis of cystic calculi, oxidate calculi often failed to show up under X-ray. They got any number of those cases at the College and they placed more reliance upon clinical examination of the subject.

Strangely enough in bitches the calculi were usually large and facetted and this type did not appear to be preceded by cystitis (when a cystitis was present the surface was usually corrugated), whereas in the dog, in his experience, the reverse was the case. Calculus formation usually followed a cystitis and the calculi were small, their surfaces corrugated and obstruction usually occurred behind the penial bone. On two occasions, as the result of the introduction of a catheter into a dog's bladder, he had seen a cystitis arise with small calculus formation.

Major Kirk said that he would like to ask the Fellows whether, in a case of that sort, where one had rid the bladder of calculi by operation, there was not a great possibility that calculi would again form. He did not quite know how to treat the animal in order to obviate recurrence, but he had prescribed hexamine, 5 grs. daily for the rest of its life. It seemed to him that there must be other preventive agents which one could give. A man recently told him that he had had an operation on his righ kidney for stone, which was removed, and that, when a similar operation for stone in the left kidney was threatening, he was advised to take salad oil. He, Major Kirk, scoffed at the idea, but was assured that a subsequent radiograph showed the stone had diminished in size. That, however, was probably due to the angle at which the photograph was taken. Human beings took lithia and Vichy waters, varalettes, etc., to minimise the deposition of salts, but he wished to know whether anybody had adopted similar and successful methods for alleviation of the condition in dogs.

He believed that the exhibited calculi were oxalate in composition, but he was going to ask Dr. Clough to determine exactly what was their nature.

Major Kirk, wished, in addition, to ask why it was that they never saw calculi in the bladder of the cat. It was common enough to find male cats with obstructed urethras in consequence of the presence of gritty or sabulous concretions, but this material had never apparently formed the nucleus of a well-defined calculus, and he had never been able to understand why.

Mr. G. H. Livesey said that he remembered that, when in practice, the majority of cases of cystic calculi which he saw were in animals of a considerable age, and as to prevention of their recurrence after operation, he generally placed them on lithia water and occasionally on potassium carbonate. But, as he had said, these cases usually occurred in animals which would not have many years to live, and he did not think that the majority would be troubled very much with recurrence. Owners were generally aware of the risk, and by giving lithia for a week or a fortnight, dropping it for a similar period and starting again, the reports he received were fairly satisfactory. He was sure that, in practice, one could not hope to keep the urine of the dog alkaline.

One would have thought that such a load of calculi in the bladder would have made the abdomen pendulous; it was a most interesting exhibit.

Major Kirk observed that there was no pendulous abdomen in the bitch from which the stones were taken; in fact, she looked quite normal, but she had a lot of abdominal fat and that might have hidden the condition to a large extent.

Professor McCunn said that Mr. Livesey's remarks made him get up to reply, for it was his opinion that recurrences of calculi were not negligible; they were most serious; so much so, that he was beginning to get dubious as to whether it was really worth while removing them. He had had numerous cases of recurrence. To take only one instance, in November two calculi were removed from a spaniel bitch. She went home and everything was quite all right. In January she had a recurrence of symptoms, and it was found that she had another calculus as large as one of the original pair of calculi.

He thought that the condition occurred as frequently in dogs as in bitches.

Replying to Mr. Livesey, Professor McCunn said that he was confident that he did not leave a trace of calculus behind on the occasion of the first operation, as he always got his assistant to feel, as well as himself, to make sure.

Professor Wright observed that his findings in the matter were in keeping with those of Dr. McCunn.

He had in mind a Pomerarian bitch. In February two calculi were removed and in May of the same year, 173.

Representatives to Council, N.V.M.A.—The following were re-elected to represent the Central Division on the Council of the N.V.M.A.: The President, Principal Hobday, Major Kirk and Captain Townson. The proposition for re-election was put by Professor McCunn and seconded by Captain Dunlop Martin.

Paper.—The President now called upon Dr. Sheather to read his paper, which was followed with the closest attention and the keenest interest. In the discussion which followed the majority of those present participated, and at its close the essayist was accorded a hearty vote of thanks, on the proposition of Mr. Perryman.

Major Kirk was also warmly thanked, on the proposition of Major Taylor, for bringing forward his exhibit. Major Kirk, the proposer, thought, "must have captured a record in the way of cystic calculi."

The meeting concluded with an expression of the Fellows' appreciation of the manner in which the President had conducted the proceedings.

J. F. Macdonald, *Hon. Secretary.*

Digitalis in Toxæmia.

Medical opinion varies as to the value of digitalis in pneumonia. It is impossible to give animals this disease, but resort can be had to a toxin, nearly all mortality in pneumonia being due to toxæmia. Experiments were made with guinea-pigs and rabbits, which were injected with diphtheria toxin. It was found that if a reliable tincture of digitalis were given to the animals they survived subsequent injections of bacterial toxin even in amounts three times in excess of the minimal lethal dose, while the control animals which had the toxin without the digitalis invariably died. It was also found that the glucosides from digitalis and strophanthus had some life-saving effect, and onabain was inactive for this purpose. The life-saving effect was also produced when the toxin was injected first, provided the injection of the digitalis was not delayed too long.—W. E. Dixon (*British Medical Journal*, 3617, 824, 1930).

Wheat as a Feeding Stuff for Live Stock.

Up to the beginning of the nineteenth century, live stock were fattened on home-produced food only, and a bullock fattened on oil cake was regarded as a great novelty. Since then oil cakes, as by-products, have been coming on the market in increasing quantities, and as at first there was no great demand for them the price was comparatively low. In more recent years the enormous increase in urban populations brought about a great demand for wheaten flour, and in the milling of the wheat large quantities of offals—bran and pollards—were made available to the stock feeder. In addition, America and Australia were producing maize which was ocean borne at low rates, with the result that cheap corn was imported in vast quantities. These factors had an adverse effect on tillage on this side of the water, and an increasing proportion of the concentrated foods fed to our live stock was imported or artificially prepared. Linseed cake and cotton cake replaced beans and peas, while pollards, bran and maize were largely used as substitutes for barley and oats.

During the last few years, however, wheat has been sold at a lower price than the farmer would have to pay for bran and pollards, and the consideration of the use of wheat as a feeding stuff for live stock has been much to the fore.

In this connection, some experiments conducted by the Irish Department of Agriculture, and designed to determine the feeding value of wheat as compared with a mixture of bran and pollards, are of considerable interest. For the purpose of the experiments, pigs were selected and divided into groups, half the individuals in each group being fed on wheat and the others on pollards and bran mixtures.

The following is a summary of the results achieved :—

Group.	No. of animals in each group.	Age at start. Weeks.	Period of experiment. Days.	Average daily live-weight increase. Lbs.	Food taken to produce 1 lb. live-weight increase. Lbs.
Group I.					
Wheat	5	8	97	1·50	3·36
Pollards & Bran	5	8	97	1·20	3·45
Group II.					
Wheat	5	10	118	1·61	3·66
Pollards & Bran	5	10	118	1·21	4·14
Group III.					
Wheat	6	10	84	1·55	3·90
Pollards & Bran	6	10	84	1·24	4·40
Group IV.					
Wheat	5	17	96	1·76	4·50
Pollards & Bran	5	17	96	1·35	4·87
Group V.					
Wheat	4	17	83	2·02	3·7
Pollards & Bran	4	17	83	1·47	4·3

These figures show that the pigs fed on wheat made a greater daily live-weight increase than those fed on pollards and bran; further, that the quantity of food required to put on 1-lb. live-weight increase was lower in the case of the wheat fed animals than in the case of those fed on pollards and bran. Expressing the difference in the average daily live-weight increase between the lots as a percentage of the smaller figure, it will be seen that the difference in favour of the wheat-fed lots varied from 25 to 37 per cent., indicating quite clearly a superiority of wheat over wheat offals for pig feeding.—*Ministry of Agriculture.*

Tannic Acid Treatment of Burns.

The fatal results of severe burns are due, in many cases, to the absorption into the circulation of toxic substances derived from protein decomposition at the site of the injury. A condition of extreme toxæmia is thereby produced, usually in 12 to 24 hours after the injury, and characterised by a marked rise in temperature, a rapid, feeble pulse, rapid breathing, a dusky-coloured skin, and often "coffee-ground" vomiting, followed by delirium and death. This condition can be prevented by the early application of tannic acid, which coagulates all damaged tissues, forming an impermeable layer preventing the absorption of toxins. The patient is put to bed, the bedclothes being supported by a cage. The site of the injury is cleansed with some antiseptic agent such as ether, if necessary under an anæsthetic. Tannic acid is then applied in 2·5 per cent. solution in warm sterile water by means of an atomiser and the application dried, by a current of warm air if possible. The application of the solution is repeated at hourly intervals, until, usually in 8 to 12 hours, a thin brown leathery coagulum is formed. Since tannic acid in aqueous solution is slowly hydrolysed to gallic acid which does not precipitate proteins, the solution should be freshly prepared for each case, but need not be made freshly for each application. Care must be taken to avoid spraying the solution into the nose and ears, and especially into the eyes, which might cause coagulation of the cornea; these parts should be protected by damp cotton wool. Sterile gauze swabs, very lightly wrung out of the warm solution, are applied to the burn and kept in position by means of cotton wool and a bandage. These dressings are renewed and the injury examined after eight hours, and then every four hours. To facilitate removal the swabs may be moistened with more solution. By this method coagulation is effected in 12 to 20 hours. Where possible, the coagulated area is left exposed to the air, the bedclothes being supported by a cage, and care being taken not to damage the film. Parts subjected to pressure may be protected by dry gauze and cotton wool; moist dressings must on no account be applied over a coagulum. After eight to fourteen days the surface beneath the coagulum becomes coated with epithelium, when the film readily peels off. This treatment may be usefully employed until 72 hours after the injury, and is not affected by the previous application of other substances, such as picric acid, but grease must first be removed. The treatment is painless, the parts becoming insensitive after two or three applications, and the formation of scar tissue, with its tendency to contract and produce deformities, is reduced to a minimum. In cases where immediate hospital treatment is not available, a first-aid dressing may be applied consisting of lint soaked in warm tannic acid solution which has been sterilised by the addition of mercuric chloride (1 in 2,000).—W. C. Wilson, (Medical Research Council, Special Report Series, No. 141, H.M. Stationery Office, price 1s.).—H. T. B., in *Pharm. Journ.*

Offsets to the Use of Liquid Paraffin.

In a letter in a recent issue of the *Lancet,* Mr. T. W. Rothwell states that he has many times noticed that the prolonged administration of liquid paraffin results in lack of growth, and even loss of weight. He cites the case of a ship's officer, who had been taking liquid paraffin for four years for habitual constipation, which grew worse instead of better. The man ate twice as much as any of his messmates, but had lost weight, and was emaciated. It is suggested that this subject suffered from self-starvation On changing over to phenolphthalein the appetite gradually became normal, and there was an increase in body weight. due to a film of oil always adhering to the mucous coat of the intestine, and so preventing absorption of the chyle. "E. H.," another correspondent in the same issue, cites Charron and Collinson's researches on rats, which proved that, contrary to the accepted belief that none of the liquid paraffin is absorbed, it accumulates in the liver, although the proportion is small. The same authors also state that ordinary liquid paraffin is a mixture not of purely aliphatic compounds, but of naphthenes (polycyclic compounds).

From The Veterinarian,

June, 1830.

Essays on Horse Medicine;

Comprehending the Theory and Practice both of the French and English Schools.

By O. P. Q.

(*Continued from page* 568.)

According to a general law of pathology (unless the nature of the case be such as to render it inexpedient or impossible), all abscesses make their way by absorption to the surface of the body, in order to evacuate their contents externally; a notable and admirable exception to this, however, presents itself in the case of an internal abscess breaking into the alimentary canal, or air passages, and yet the same end is obtained, *viz.*, that of external evacuation. As soon as the purulent matter has arrived underneath the skin, the tumour becomes conical or circumscribed, and soft and fluctuating; the part is said to have *festered,* and to be now ripe, or fit for evacuation. At this stage, should no surgical means be used, the part of the skin which feels softest, and which is commonly the most prominent spot in the tumour, and is further indicated by a separation or actual loss of hair, will continue to grow thinner and thinner, in medical language to *point,* until it at length bursts from the pressure of the matter against it, and the abscess is said to *break.*

I know of no case in which it is not advisable to open an abscess rather than suffer it to break; and as a general rule it is good practice to give vent to the matter as soon as, or very soon after, it has manifested its presence. During the formation of an abscess, we make use of means, fomentations and poultices, to encourage the process; or we endeavour, by what we term *discutients,* to disperse the tumour by producing a reabsorption of the matter deposited into the system; it being now admitted by pathologists that repelling matter back from whence it came is nowise dangerous to the animal body; or, thirdly, we apply stimulants to the tumour, such as blisters, which sometimes have the effect of suppressing it; at others, of bringing it forward to maturation.

Veterinarians are in the habit of adopting *two* modes of opening abscesses—*incision* and *cauterization.* The ordinary method of letting out the matter is to plunge a broad-shouldered lancet into the pointing spot of the tumour; and at the same time by a sudden turn of the point of the lancet outwards, to extend the incision in whatever direction it may seem best to dilate the opening, which is rarely of sufficient dimensions without the subsequent incision; indeed, if the tumour is one of magnitude, a lancet is an insufficient instrument; either a sharp-pointed bistouri or a double-edged scalpel should be employed, it being the grand *desideratum,* in almost every case, to make the wound such as will give a free and ready exit to the matter. The cavity being opened, a probe of large size is commonly introduced and moved about in various directions, in order to remove all obstacles to the efflux of the matter; or the same may be done with the finger. Heurtrel D'Arboval, however, warns us against rupturing any of the little chords which are every now and then found to run across the cavity, lest we destroy the vitality of the skin, to which, he says, they convey blood vessels and nerves.

In the case of large abscesses, or where there are dependent places in which the matter lodges, in spite of the opening already made, it is often good practice to introduce a *seton;* which may be done by making another hole through the skin, and drawing a piece of coarse broad tape through the cavity, making knots at the ends of it to prevent them from entering the interior. Some tie the two ends together; but this is in general a very objectionable, not to say dangerous practice; since, should the animal, by any chance, hitch the loop upon anything, the seton will probably get torn out, and extensive laceration ensue.

The actual cautery is not often used, nowadays, for opening abscesses; still there are cases wherein it seems the preferable mode of proceeding. The case of chronic abscess, in which suppuration has been slow and tedious, and of an unhealthy nature, is the one I more particularly allude to. A protracted and immature suppurative process bespeaks equal protraction and sluggishness in the granulative action, and calls upon us for the employment of excitants; and one of the most potent and efficacious among them is the hot iron, on which account I would use it in preference to the lancet in cases of this description.

Having discharged the matter, our next consideration is what dressing, or if any, is required for the abscess, the cavity of which must be filled up by a process of granulation, and the lost skin renewed by cicatrization. In ordinary cases, some astringent dressing is all that is required; and the best, as well as the most simple, are solutions (for I prefer them to ointments), of white vitriol or alum; though some practitioners prefer stimulants, such as spirits of turpentine, or tincture of myrrh. Should the discharge be not of the most laudable character, an escharotic dressing is proper, such as a solution of blue vitriol. A solution of lunar caustic, gr. x or ʒj to ℥j of water, is an excellent corrective of any unhealthy tendency. In general, the fomentation and poultices should be persevered in after the matter is discharged. Now and then, where the cavity is extensive, and the situation admits of it, much benefit may be derived from bandaging the parts, so as to keep the opposed surfaces of the cavity in contact; in which way they may be often got to adhere, and the cure in this manner accelerated.

Rabies.

Two cases of rabies have recently occurred in dogs for which licences had been issued authorising their landing in Great Britain, subject to the six months' quarantine prescribed by the Importation of Dogs and Cats Order of 1928.

In the first case, a dog which had been landed in London from Morocco on May 8th died on the morning of May 9th. The carcass was sent to the Ministry's Laboratory for examination, and tests were made which established the fact that death was due to rabies. So far as the Ministry is aware, no persons were bitten by the affected animal.

The circumstances in the second case were as follows:—On May 15th the Ministry received information to the effect that a dog belonging to a passenger on M.V. "Domala," which was due to arrive at Plymouth from India the following morning, had bitten two persons on board and was suspected of being affected with rabies. Six other dogs were also accompanying passengers on this vessel, and licences had been issued, permitting the landing of all the dogs subject to their detention and isolation for a period of six months. The suspected dog was destroyed on May 16th, but the carcass was by request of the Ministry retained, and on examination at the Ministry's Laboratory the existence of rabies was confirmed. One other dog was bitten by the affected dog, and this was destroyed by the ship's doctor. All cats on board were also subsequently destroyed.

The dogs which were landed were removed under supervision to approved premises for isolation and detention. The persons who had been bitten by the affected dog were taken to London and received anti-rabic treatment.

Since the year 1919 there have been 12 cases of rabies confirmed in imported dogs, and there is no doubt whatever that widespread epidemics of a terrible disease would have followed the importation of these dogs into this country. The regulations governing the importation may be considered by some dog owners to be severe, but these persons will, on consideration, realise how necessary is safety to mankind in the case of hydrophobia, and that a strict observance of the regulations is required, not only in the interests of dog owners themselves, but in those of the whole country.

Notes and News.

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events.

July 7th.—Meeting of the Editorial Committee, N.V.M.A., 4.30 p.m., 2 Verulam Buildings, Gray's Inn.

July 7th.—R.C.V.S. Membership Examination commences.

July 8th.—Summer Outing of the Derbyshire Division, N.V.M.A., to Haddon and Chatsworth.

July 11th.—Meeting of the North Wales Division, N.V.M.A., at Corwen.

July 18th.—Meeting of the Mid-West and South Wales Division, N.V.M.A., at Bridgwater.

July 24th.—Meeting of the Eastern Counties Division, N.V.M.A., at Cambridge.

Aug. 2nd.—**Professor James Macqueen Luncheon and Presentation, St. Ermin's Hotel, Westminster, 1 p.m. N.V.M.A. Conference on Grading of Milk, Central Hall, Westminster, 2.30 p.m.**

AUGUST 4th to 9th.—11th INTERNATIONAL VETERINARY CONGRESS, CENTRAL HALL, WESTMINSTER.

A circular has been issued this week to all members who have not enrolled as members of the forthcoming Congress. We hope that the response will be immediate. No more important event in our annals will occur for at least two generations, and certainly no modern veterinarian can afford to be ignorant of the matters to be discussed at the Congress. It is obvious that the whole profession cannot actually attend at Westminster, but every member must see to it that he subscribes to the Congress in order that he may secure a copy of the proceedings. The cost of producing these will, in fact, be more than the amount of the subscription, which is 30s. (ladies accompanying members, 5s.).

We are pleased to be able to announce that a Committee of Honour has been formed, including the Lord Mayor of London, the Minister of Agriculture, and the Ambassadors and Ministers of every foreign nation accredited to this country. The number of nations represented by the membership list is about 60, many of whom have appointed official delegates.

The Railway Companies have agreed to extend the period of availability of the cheap tickets to members, which will now cover the period, August 1st to 16th.

The Authorities of the British Museum have very kindly undertaken to arrange a special exhibition of Historical MSS. and early printed books dealing with Veterinary Science, and this will be open to members of the Congress on the afternoons of Wednesday, Thursday and Friday, August 6th to 8th.

It will greatly assist the General Secretary if applications for membership are sent in soon, as he and his small staff will be better able to cope with the work if the bulk of the applications are received in good time.

Free State Veterinary Register.

"Plans have practically been completed for the setting up of a separate register for veterinary surgeons in the Free State, following the arrangements already made for medical men and dentists," says the *Irish News*.

"A Bill on this basis will be introduced in the Dail next session.

"It is understood that veterinary surgeons qualified here will also possess the right to registration in England.

"This arrangement will permit of many young men who have to seek employment in England enjoying the same privileges as have existed up to now."

R.C.V.S. Obituary.

Bainbridge, Joseph, East Lodge, Ecton, Northampton. Graduated, London, April 2nd, 1879. Died, June 22nd, 1930. Age, 81 years.

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McLean, John, 54 Wellington Road, Dewsbury, Yorks. Graduated Glasgow, April 10th, 1882. Died June 28th, 1930. Age, 65 years.

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Death of Mr. J. R. Robins.

The death has occurred at his residence, Winton Lodge, Chapel Road, Worthing, of Mr. Joseph Rowse Robins, a well-known veterinary surgeon who, in addition to holding the appointments of Veterinary Inspector to the Worthing Corporation and the West Sussex County Council, also acted as local Inspector for the Ministry of Agriculture and Fisheries.

Mr. Robins, who was 61 years of age, qualified at Glasgow in 1893, and came to Worthing about 12 years ago, taking over the practice previously carried on by the late Mr. Henry Smith at premises which have now been a centre of veterinary skill locally for more than 75 years.—*Worthing Gazette.*

D.V.S.M. Examination.

At the examination recently held in Edinburgh for the Diploma in Veterinary State Medicine, the following candidates were declared successful:—W. P. B. Beal, W. S. Davison, G. H. Mills, A. F. O'Dea, G. F. Pickering, E. G. Robertson, A. P. Steele, J. G. Souter.

Personal.

Will.—Victor Pride Jones, of Sackville House, Newmarket, Veterinary Surgeon to the Jockey Club since 1926, and largely concerned with the purchase and export of thoroughbred stock (net personalty, £1,740), £3,281.

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Marriage.—Pottie-Jaffrey.—At the Central Hotel, Glasgow, on June 5th, 1930, by the Rev. G. Kerr M'Kay, of Johnstone Parish Church, Alexander Pottie, M.R.C.V.S., The Gables, Shandon, to Pollie Mills, daughter of the late David Jaffrey, Koilpatti, India, and niece of the late James M. Jaffrey, Home Park, Johnstone.

War-Scarred—in the Post.

A letter, posted nearly 14 years ago, has just been delivered in Lincoln. The envelope bears only a penny stamp. The letter was posted to a local man, Private Frank S. Rowe, of the Army Veterinary Corps, who was serving in France, on September 23rd, 1916. It may have reached France when Mr. Rowe was transferred to the Royal Fusiliers, and thus missed him.

Judging by the marks and abbreviations on the envelope, the letter has travelled over a large part of the Great War area.—*Evening Standard.*

The Editor acknowledges the receipt of the following:—

Report of a meeting of the Lancashire Division, N.V.M.A., from Mr. John Spruell, Hon. Secretary.

Communications from Mr. T. Le Q. Blampied (Jersey), Dr. G. A. Fothergill (West Lothian), Major H. Kirk (London), Mr. T. F. Prime (Upper Norwood), Dr. B. Sjollema (Utrecht), and S. Smith (Sydney, N.S.W.).